REMARKS

The Examiner is thanked for the careful examination of the application, and for the suggestions for amending the application. However, in view of the foregoing amendments and the remarks that follow, the Examiner is respectfully requested to reconsider the present application.

SPECIFICATION:

The specification has been amended as suggested by the Examiner, and in other appropriate places, to ensure that the reference numerals in the specification conform to those in the figures.

CLAIMS OBJECTION:

Claim 18 has been amended as suggested by the Examiner to correct an obvious typographical error. The amendment is not intended to change the scope of the claim.

ART REJECTIONS:

Claims 1-3 and 5-18 have been rejected under 35 U.S.C. §103(a) as being

unpatentable over U.S. Patent No. 5,862,257, hereinafter Sekine, in view of U.S. Patent

No. 6,408,109, hereinafter Silver.

In response to this rejection, claim 1 has been amended to clarify that the density

level determining circuit determines multi-level density levels in the plurality of sub-pixels

in the target pixel. As now clarified, the target pixel is divided into sub-pixels, and each of

the sub-pixels is expressed with multi-level density data.

Sekine discloses a target pixel that is compressed of a plurality of sub-pixels, as can

be seen in Figs. 5 and 10. However, as is also clear from Figs. 5 and 10, each of the sub-

pixels is expressed as binary data, not as multi-level data. See Fig. 5D and 10B, and col.

10, lines 8-12. In view of the fact that Sekine does not teach or suggest that the sub-pixels

of each pixel are defined with multi-level density data, Sekine does not teach or suggest the

density level determining circuit of claim 1. Accordingly, the Examiner is respectfully

requested to reconsider and withdrawal the rejection of claim 1.

Similar issues apply to claim 15, which has also been amended to define a step of

determining multi-level density levels in a plurality of sub-pixels in the target pixel in

accordance with the density of the target pixel and the discriminated edge direction of the

target pixel. As set forth above, Sekine uses binary data to define the sub-pixels, and does

not teach or suggest a target pixel comprising a plurality of sub-pixels defined with multi-

level density data. Accordingly, claim 15 is also patentable over the combination of Sekine

and Silver.

The remaining claims 2, 3, 5-14, and 16-18 depend from either claim 1 or claim 15, and are thus patentable over the applied art at least for the reasons set forth above with respect to claims 1 and 15.

Claim 4 has been rejected under 35 U.S.C. §103(a) as being unpatentable over Sekine and Silver, and further in view of U.S. Patent No. 5,257,116, hereinafter Suzuki. Claim 4 depends from amended claim 1, and is thus patentable over the applied prior art at least for the reasons set forth above with claim 1.

However, newly added claim 20 is a combination of original claim 1 and original claim 4, without the aforementioned amendments to claim 1. New claim 20 defines the edge judgment circuit as canceling the discriminated edge direction when the density level of a pixel adjacent to the target pixel in the edge direction is larger than a threshold value. In the Official Action, it is alleged that Suzuki discloses a high definition image generating system comprising an edge direction detecting circuit that cancels a discriminated edge direction when the density level of a pixel adjacent to the target pixel in the edge direction is larger than a threshold value. For support for this proposition, col. 6, lines 18-52 is cited. However, a careful review of the Suzuki reference indicates that it is not the density level of a pixel that is compared to a threshold value. Instead, Suzuki compares an edge value to a threshold value, and the edge value is calculated according to a formula set forth in the middle of col. 6 of Suzuki. Thus, Suzuki does not teach or suggest that the discriminated edge direction is canceled when a density level of a *pixel* adjacent to the target pixel in the edge direction is larger than a threshold value. Accordingly, new claim 20, which is identical to original claim 4, is clearly patentable over the cited prior art.

To further define the protection to which Applicants are entitled, new claim 19 is also submitted herewith. New claim 19 is identical to original claim 2 and original claim 1, as filed.

In the rejection of original claim 2, the Official Action indicates that the density controller circuit of Sekine sets a density level setting parameter for each of the sub-pixels in the target pixel in accordance with the edge direction of the target pixel discriminated by the edge judgment circuit. However, a careful review of Sekine indicates that Sekine does not show a density controller which sets density setting level parameters for each of the sub-pixels. For example, turning attention to Fig. 3, each raster data D1 through D6 relates to a respective pixel. See, Col. 9, lines 6-8, wherein it explains that the upper most bit of each line of data discriminates whether the *pixel* is half-tone or vector data. Turning attention to col. 10, lines 42-55, it is clear that the selector selects parameter data of either half-tone data or vector data based on the first bit of each line of raster data. Since each line of raster data refers to a pixel, and not a sub-pixel, Sekine does not teach or suggest setting a density level setting parameter for each of the sub-pixels. At best, Sekine sets parameters for each pixel, not sub-pixels.

Accordingly, new claim 19, which is substantially identical to original claim 2, is also patentable over the applied prior art.

In the event there are any questions concerning this response, or the application in general, the Examiner is respectfully urged to telephone the undersigned attorney so that prosecution of the application may be expedited.

Respectfully submitted,

BURNS, DOANE, SWECKER & MATHIS, L.L.P.

By: _William C. Rowland_

William C. Rowland
Registration No. 30,888

P.O. Box 1404
Alexandria, Virginia 22313-1404
(703) 836-6620

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Page 8, Paragraph Beginning at Line 20

More specifically, in the image processor, an image-data output device 10 outputs

the digital image data received from an image reader, a host computer or the like (not

shown). In this example, the image data are outputted as gradation data consisting of eight

bits per pixel. An edge judgment section 12 determines the difference in gradation

between a target pixel and each of the adjacent pixels thereof by using the gradation data

outputted from the image-data output device 10 so as to discriminate an edge direction in

the main scan direction according to the combination of the differences in gradation. Then,

based upon the judgement of the edge judgment section 12, a density level controller 14

generates a parameter signal for controlling the center of gravity in density in the pixel in

the unit of sub-pixel obtained by dividing the target pixel in the main scan direction. On

the other hand, a gamma correction section [20] 16 subjects the gradation data received

from the image data output device 10 to non-linear conversion so as to correct the

non-linear curvature in the gradation property in a print section [26] 22. Next, a density

level setter [22] 18 controls the density level for the data corrected by the gamma

correction section [12] 16, by using the density control parameter signals generated by the

density level controller section 14 so as to change the center of gravity in density in the

pixel. Thus, the density is controlled by the density level controller section 14 and the

density level setter [22] 18 in the unit of sub-pixel, and the data corrected by the gamma

correction section [20] 16 are converted to density levels (or digital gradation data) for

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printing in the unit of sub-pixel. A digital-to-analog (D/A) converter [24] <u>20</u> converts a

digital gradation data obtained by the density level setter [22] <u>18</u> to an analog signal and

outputs it to a laser driver in the print section [26] <u>22</u>. The print section [26] <u>22</u> modulates

the intensity of a laser beam in the unit of sub-pixel in accordance with the input signal.

Thus a half-tone image is formed on a recording medium in raster scan.

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Marked-up Claims -

1.   (Amended) An image processor which processes multi-level image data on density levels of pixels, comprising:

an edge judgement circuit which discriminates an edge direction of a target pixel from differences in density level between the target pixel and adjacent pixels thereof based upon the multi-level image data; and

a density level determining circuit which determines multi-level density levels in a plurality of sub-pixels in the target pixel, where the target pixel is divided into the sub-pixels, in accordance with the density level of the target pixel and the edge direction of the target pixel discriminated by the edge judgment circuit.

15.   (Amended) A method for processing processes multi-level image data on density levels of pixels, where a pixel is divided into a plurality of sub-pixels, comprising the steps of:

discriminating an edge direction of a target pixel from differences in density level between the target pixel and adjacent pixels thereof based upon the multi-level image data; and

determining multi-level density levels in a plurality of sub-pixels in the target pixel in accordance with the density level of the target pixel and the discriminated edge direction of the target pixel.

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Marked-up Claims -

18.   (Amended) The method according to claim 15 further comprising the step

of performing smoothing on image data of the pixel, on which an edge is discriminated

[direction], by using an asymmetric filter having the target pixel at a center thereof,

wherein in said determining step density level of each of the sub-pixels in the target pixel is

determined based on the density level of the smoothed image data of the target pixel and on

the discriminated edge direction of the target pixel.